

On the occurrence of *Triops mavliensis* (Tiwari), Notostraca (Crustacea), in the Okhamandal Region of Saurashtra (India)

BY

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(With four text-figures)

INTRODUCTION

Like other Branchiopods, *Triops* is an archaic genus that has been evolutionarily stagnant since the Triassic period. Because of its rare occurrence, discontinuous distribution, variable sex ratio and peculiar mode of reproduction, it has attracted considerable attention. In India, major work on this group was done by Gurney (1925), Mahabale (1939), Tiwari (1952, 1954, 1956) and Karande & Inamdar (1959). Very little is known about the distribution of these forms, and information about their reproduction is also scanty. Till now *Triops* has been collected from nine different localities in India. They were first recorded from Gandharbar (7000 ft.) in Kashmir by F. Smith in 1907 and identified by Gurney (1925) as *Apus cancriformis* Schaefer. Kemp (1911) recorded this species from Kashmir, Sarghodha (now in Pakistan) and Bulundshahar (U.P.).

Triops also occurs in Panchgani (4378 ft.) in Maharashtra State. These were identified by Gurney (1925) as *Apus asiaticus* Gurney and were thought to be similar to those collected from Central Asia and Baghdad. Later, Tiwari (1952) redescribed the forms collected from Panchgani as a new species *Apus orientalis* Tiwari.

Triops is also recorded from Ahmedabad (Gujarat) by Mahabale (1939) who described them as *Apus cancriformis* Schaefer.

Sixteen female specimens of a *Triops* species collected at Mavli (Rajasthan) were described by Tiwari (1952) as a new species *Apus mavliensis* Tiwari. A single specimen of *Triops* recorded by Chacko (1950) from Tirunelveli (Madras) was later identified by Tiwari (1952) as *Apus*

sudanicus Brauer. Finally, Mathur & Sindhu (1956) recorded an unidentified species of *Triops* from Pilani (Rajasthan).

During recent visits to Port Okha (Gujarat) in June 1966 and August 1966, specimens of *Triops*, together with other Branchiopods, were collected from shallow freshwater ponds. Collections were made from three distinct places, namely, Okha town proper, Gopi village (12 miles from Okha) and Poshetra village (23 miles from Okha). These specimens were identified as *Triops mavliensis* (Tiwari), and have revealed a few facts about the biology of this species, including the morphology of the male, which have not been recorded before.

OBSERVATIONS

The area from which collections were made was a coastline of coralline rocks with occasional very shallow ponds. The depth of these ponds does not exceed four feet. The annual rainfall of this region is 4 to 20 inches. The rainy months are from late June to September, the peak being in July and August. For most part of the year the ponds are dry, but with the onset of monsoon, they are filled and remain so for five to six weeks.

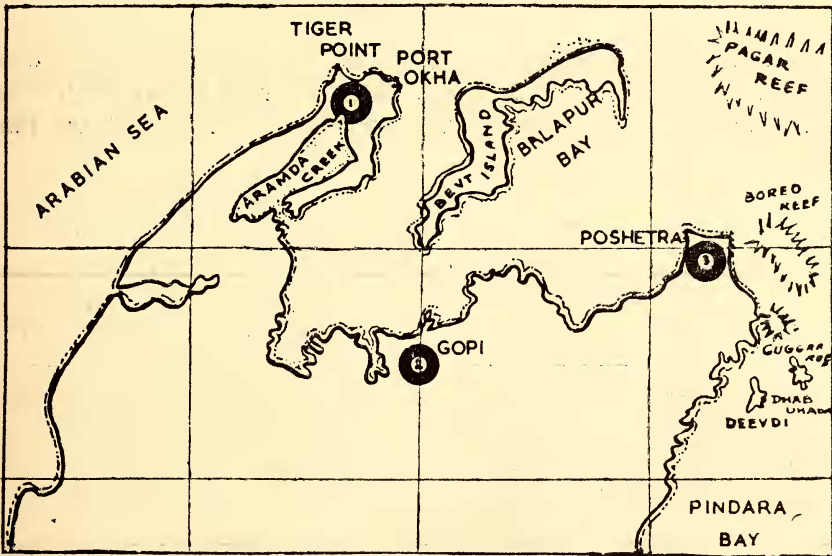


Fig. 1. Map of Okha and surrounding places from where *Triops* were collected.

Two visits to the area were made on 30 June and 15 August of the year 1966, and specimens of *Triops*, together with other Branchiopods, were collected from freshwater ponds. Places of collection are indicated

in Fig. 1. During the first visit 141 males and 238 females were collected, while during the second visit 21 males and 56 females were obtained.

The occurrence of *Triops* at high altitude led to the belief that the factors affecting their distribution are correlated with heavy rainfall, characteristic soil condition and low temperature. Barnard (1929) has also expressed similar views with regard to the South African species of *Triops*. However, our present collections were made from shallow ponds over coralline rocks, where climatic conditions are quite different from those prevailing at high altitudes. It is, therefore, obvious that the nature of soil, rainfall or temperature, are not the principal governing factors in the distribution of *Triops*.

The occurrence of *Triops* at sea-level has been recorded previously by Gurney (1907), Weldon (1909) and Balfour-Browne (1948) but this is the first record in India, at sea-level.

Phyllopods, except one species of *Branchipus* and one species of *Limnetis* (both cave-dwelling and blind) are not found in underground waters or wells. However, while collecting *Triops* from Poshetra (Fig. 1), from a flooded well, we also collected other Phyllopods namely *Eocycticus* sp. and *Streptocephalus simplex* (Gurney).

MORPHOLOGY

The morphology of fifty-five females and fifty-three males were studied in detail, and compared with the description given by Tiwari (1952) which was based on only sixteen female specimens. The results are summarised in Tables 1 to 4.

TABLE 1
Triops mavliensis (Tiwari)—FEMALE

		Tiwari's observations	Our observations
Total body length	..	8.8 to 15.8 mm.	8.00 to 22.50 mm.
Apodal segments	..	8 to 10	8 to 10
Sulcal spines	..	36 to 44	36 to 54
Exposed segments behind sinus	..	20 to 24	15 to 26
Post-genital segments	..	25 to 27	24 to 29
Movable segments	..	36 to 39	35 to 41

With the exception of the above variation in measurements and number, our specimens agree in general with the description of the female by Tiwari (1952).

Table 2 shows the distribution of morphological variations in the female.

Males were collected in fairly large numbers. There is, however, a clear distinction between the two sexes in this species, as in many others. The males are yellowish brown in colour while the females are light green. This character is clearly seen when the specimens are fresh. The carapace (Fig. 2) is oval in the female. This character is distinctive in females

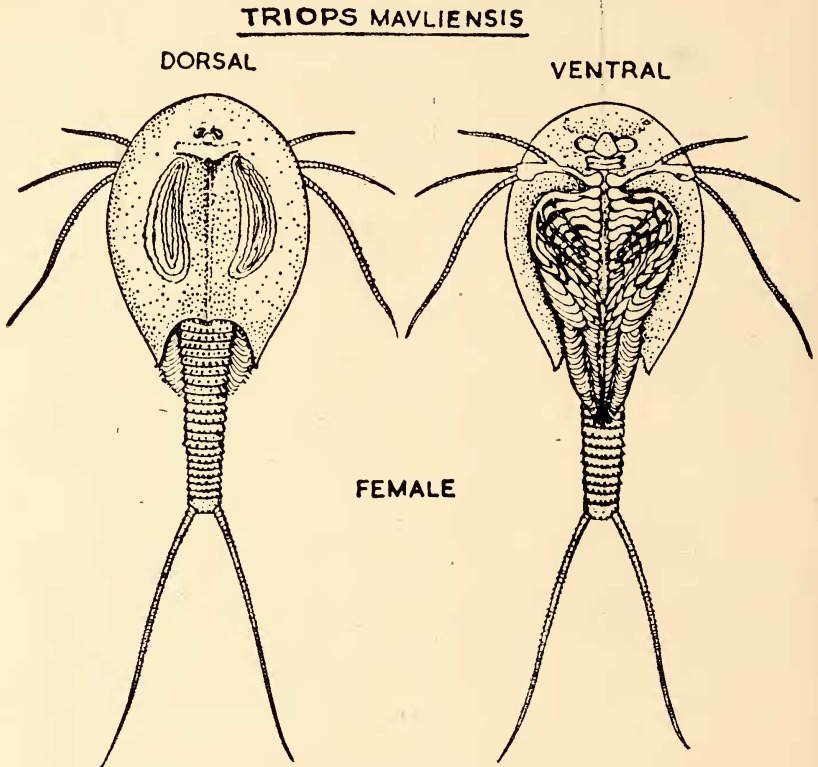


Fig. 2. Dorsal and ventral views of female *Triops mavliensis* (Tiwari).

because of the curvature in the mid-dorsal region. In the male, however, the carapace (Fig. 3) is almost flat, thus appearing more or less circular. The shape of the carapace as well as the colour are often variable, and hence cannot be accepted as dimorphic characters. A more dependable dimorphic character, according to our observations, is the armature of the telson. The spines on the dorsal surface of the telson are more or less similar in both the sexes. The armature of the ventral side, however, differs in the two sexes (Fig. 4). In the male, the ventral median spines and the post-marginal spines are short, stout and brown (due to chitinous material) whereas in the female they are slender, weak and yellowish. This difference, though not seen in other species of *Triops*, is very distinctly seen in this species. Out of the 238 females

TABLE 3
Triops mavliensis (Tiwari)—MALE. DISTRIBUTION OF VARIATIONS IN MORPHOLOGY

<i>Character</i>	<i>Distribution</i>												
Apodal Segments	Number	11	12	13									
	Individuals	16	29	8	Total Individuals=53								
Exposed Segments	Number	18	19	20	21	22	23	24	25	26	27	28	29
	Individuals	1	0	0	4	3	2	15	5	8	9	5	1
	Total Individuals=53												

in our first lot, there were 5 females (with brood pouch) which had a yellow and circular carapace characteristic of the male, but their telson

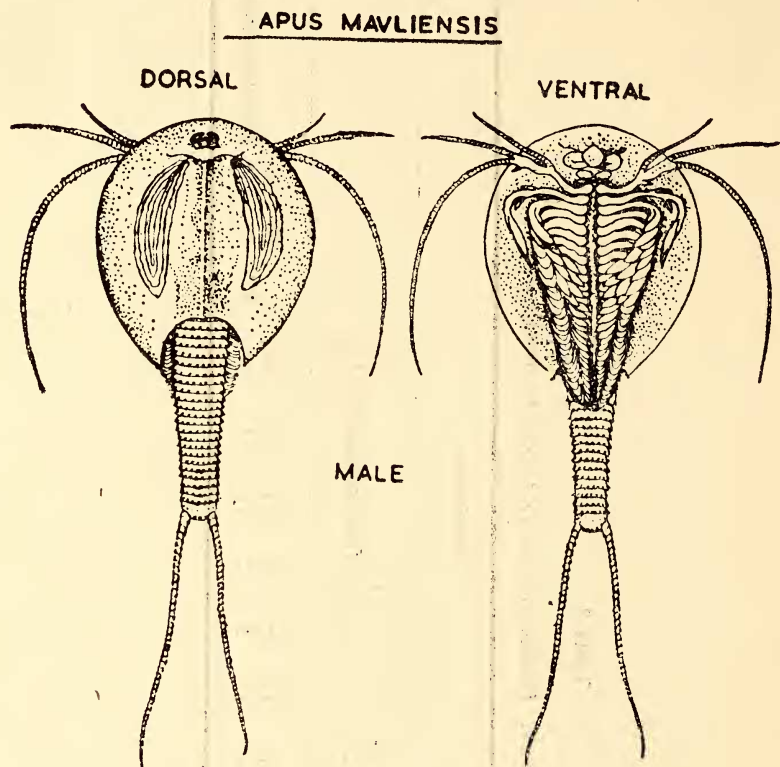


Fig. 3. Dorsal and ventral views of male *Triops mavliensis* (Tiwari).

showed the distinctive female characteristics. The furcal spines also differ in the two sexes to a certain extent. They are slender and yellowish in the female; and are shorter and brownish in the male. This distinction requires careful examination.

The characteristics of the male of *Triops mavliensis* (Tiwari) are as follows.

TABLE 4

Triops mavliensis (Tiwari)—MALE

Total body length	..	9.50 to 21.00 mm.
Apodal Segments	..	11 to 13
Sulcal spines	..	38 to 51
Exposed segments	..	18 to 28

In all 53 males were examined out of a collection of 162. Table 3 shows the distribution of variation in morphology of the male.

SEX RATIO

The sex ratio is considered to be variable in *Triops* and males are said to be rare amongst European species. Main (1953) records that males

ARMATURE OF TELSON
MALE

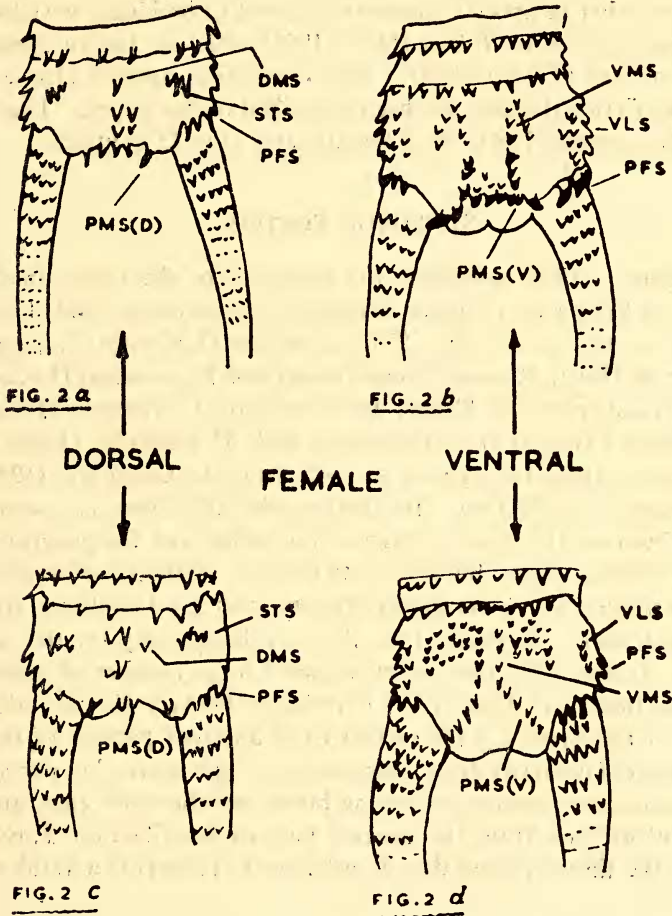


Fig. 4. Armature of telson of male and female specimens of *Triops mavliensis* (Tiwari).

- DMS—Dorsal median spines.
- PFS—Prefurcal spines.
- PMS(D)—Posterior marginal spines—dorsal.
- PMS(V)—Posterior marginal spines—ventral.
- STS—Setal spines.
- VLS—Ventro lateral spines.
- VMS—Ventro median spines.

are abundantly found in Australian species. As far as Indian species are concerned Tiwari (1954) has recorded that males are not so rare in *Triops*

orientalis (Tiwari) while they are said to be rare in *Triops cancriformis* (Schaefer). The sex ratio in *Triops mavliensis* (Tiwari) in our collection works out at 37.5% males to 62.5% females. The occurrence of males decreases towards the end of the monsoon.

APODAL SEGMENTS

The number of apodal segments is found to be highly variable in the Australian species of *Triops* (Main 1953) while in Indian species it is fairly constant (Tiwari 1954). This conclusion applies also to *Triops mavliensis* (Tiwari) which has been described in this paper. The number of apodal segments is 8 to 10 in females and 11 to 13 in males.

SYSTEMATIC POSITION

Longhurst (1955) considers the armature of the telson in different species of *Triops* as of great taxonomic importance, and basing his analysis on this he considers *T. longicaudatus* (LeConte), *T. australiensis* (Spencer & Hall), *T. cancriformes* (Bosc) and *T. granarius* (Lucas) to be the only valid species of *Triops*. In his opinion *T. orientalis* (Tiwari) and *T. mavliensis* (Tiwari) are synonymous with *T. granarius* (Lucas). The differences in these two species are, according to Longhurst (1955), due to geographic distribution. He further adds that there is a strong correlation between the spine pattern of the telson and the geographic distribution of these forms, but none with the sex. If this conclusion is based on the samples of *T. mavliensis* (Tiwari) sent to Longhurst from the Zoological Survey of India, then they are based only on the study of females. In our collection we examined a large number of males also, and found that there does exist a correlation between the telsonic spines and sex in this species. He explains the different pattern of telson in *T. mavliensis* (Tiwari) as due to immaturity of specimens, but our samples contained mature females possessing brood pouches with eggs, and their telson still differed from the general pattern described for *T. granarius* (Lucas). We therefore feel that *T. mavliensis* (Tiwari) is a valid species.

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